accuracy of one percent. Expansion shall be recorded in cubic cm.

(b) No leaks shall appear and permanent volumetric expansion shall not exceed 10 percent of the total volumetric expansion at test pressure.

§ 179.500–15 Handling of tanks failing in tests.

(a) Tanks rejected for failure in any of the tests prescribed may be reheat-treated, and will be acceptable if subsequent to reheat-treatment they are subjected to and pass all of the tests.

(b) [Reserved]

§ 179.500–16 Tests of pressure relief devices.

(a) Pressure relief valves shall be tested by air or gas before being put into service. Valve shall open at pressure not exceeding the marked test pressure of tank and shall be vapor-tight at 80 percent of the marked test pressure. These limiting pressures shall not be affected by any auxiliary closure or other combination.

(b) For pressure relief devices that incorporate a rupture disc, samples of the discs used shall burst at a pressure not exceeding the marked test pressure of tank and not less than 7/10 of marked test pressure.

[Amdt. 179–32, 48 FR 27708, June 16, 1983, as amended at 66 FR 45391, Aug. 28, 2001]

§ 179.500–17 Marking.

(a) Each tank shall be plainly and permanently marked, thus certifying that tank complies with all requirements of this specification. These marks shall be stamped into the metal of necked-down section of tank at marked end, in letters and figures at least ¼ inch high, as follows:

(1) Spec. DOT-107A * * * *, the * * * * to be replaced by figures indicating marked test pressure of the tank. This pressure shall not exceed the calculated maximum marked test pressure permitted, as determined by the formula in § 179.500–4(b).

(2) Serial number immediately below the stamped mark specified in paragraph (a)(1) of this section.

(3) Inspector's official mark immediately below the stamped mark specified in paragraph (a)(1) of this section.

(4) Name, mark (other than trademark), or initials of company or person for whose use tank is being made, which shall be recorded with the Bureau of Explosives.

(5) Date (such as 1–01, for January 2001) of tank test, so placed that dates of subsequent tests may easily be added.

(6) Date (such as 1–01, for January 2001) of latest test of pressure relief device or of the rupture disc, required only when tank is used for transportation of flammable gases.

(b) [Reserved]

[29 FR 18995, Dec. 29, 1964, as amended by Amdt. 179–52, 61 FR 28682, June 5, 1996; 66 FR 45391, Aug. 28, 2001]

§ 179.500–18 Inspection and reports.

(a) Before a tank car is placed in service, the party assembling the completed car shall furnish to car owner, Bureau of Explosives, and the Secretary, Mechanical Division, Association of American Railroads, a report in proper form certifying that tanks and their equipment comply with all the requirements of this specification and including information as to serial numbers, dates of tests, and ownership marks on tanks mounted on car structure.

(b) Purchaser of tanks shall provide for inspection by a competent inspector as follows:

(1) Inspector shall carefully inspect all material and reject that not complying with § 179.500–5.

(2) Inspector shall stamp his official mark on each forging or seamless tube accepted by him for use in making tanks, and shall verify proper application of heat number to such material by occasional inspections at steel manufacturer's plant.

(3) Inspector shall obtain certified chemical analysis of each heat of material.

(4) Inspector shall make inspection of inside surface of tanks before necking-down, to insure that no seams, cracks, laminations, or other defects exist.

(5) Inspector shall fully verify compliance with specification, verify heat treatment of tank as proper; obtain samples for all tests and check chemical analyses; witness all tests; and report minimum thickness of tank wall,

maximum inside diameter, and calculated value of D, for each end of each tank as prescribed in §179.500–4(c).

(6) Inspector shall stamp his official mark on each accepted tank immediately below serial number, and make certified report (see paragraph (c) of this section) to builder, to company or person for whose use tanks are being made, to builder of car structure on which tanks are to be mounted, to the Bureau of Explosives, and to the Secretary, Mechanical Division, Association of American Railroads.

(c) Inspector's report required herein shall be in the following form:

(Place) _____
(Date) _____

STEEL TANKS

It is hereby certified that drawings were submitted for these tanks under AAR Application for Approval _____ and approved by the AAR Committee on Tank Cars under date of _____.
Built for _____ Company
Location at _____
Built by _____ Company
Location at _____
Consigned to _____ Company
Location at _____
Quantity _____
Length (inches) _____
Outside diameter (inches) _____
Marks stamped into tank as required in §179.500–17 are:

DOT-107A* * * *

NOTE 1: The marked test pressure substituted for the * * * * on each tank is shown on Record of General Data on Tanks attached hereto.

Serial numbers ___ to ___ inclusive
Inspector's mark _____
Owner's mark _____
Test date _____
Water capacity (see Record of Hydrostatic Tests).
Tare weights (yes or no) (see Record of Hydrostatic Tests).
These tanks were made by process of _____

Steel used was identified as indicated by the attached list showing the serial number of each tank, followed by the heat number.

Steel used was verified as to chemical analysis and record thereof is attached hereto. Heat numbers were stamped into metal. All material was inspected and each tank was inspected both before and after closing in ends; all material accepted was found free from seams, cracks, laminations, and other defects which might prove injurious to strength of tank. Processes of manufacture and heat-treatment of tanks were witnessed and found to be efficient and satisfactory.

Before necking-down ends, each tank was measured at each location prescribed in §179.500–4(c) and minimum wall thickness in inches at each location was recorded; maximum inside diameter in inches at each location was recorded; value of D in inches at each location was calculated and recorded; maximum fiber stress in wall at location showing larger value for

$(D^2+d^2)/(D^2-d^2)$

was calculated for 7/10 the marked test pressure and recorded. Calculations were made by the formula:

$S=[0.7P(D^2-d^2)/(D^2+d^2)]$

Hydrostatic tests, tensile test of material, and other tests as prescribed in this specification, were made in the presence of the inspector, and all material and tanks accepted were found to be in compliance with the requirements of this specification. Records thereof are attached hereto.

I hereby certify that all of these tanks proved satisfactory in every way and comply with the requirements of Department of Transportation Specification No. 107A* * * *.

(Signed) _____
(Inspector)
(Place) _____
(Date) _____

RECORD OF CHEMICAL ANALYSIS OF STEEL FOR TANKS

Numbered _____ to _____ inclusive
Size __ inches outside diameter by __ inches long
Built by _____ Company
For _____ Company

Heat No.	Tanks represented (serial Nos.)	Chemical analysis							
		C	Mn	P	S	Si	Ni	Cr	Mo

These analyses were made by
(Signed) _____
(Place) _____
(Date) _____

RECORD OF CHEMICAL ANALYSIS OF STEEL IN TANKS

Numbered _____ to _____ inclusive
Size ____ inches outside by ____ inches long
Built by _____ Company
For _____ Company

Heat No.	Tanks represented by test (serial Nos.)	Elastic limit (psi)	Tensile strength (psi)	Elongation (percent in 2 inches)	Reduction of area (percent)

(Signed) _____
(Place) _____
(Date) _____

RECORD OF HYDROSTATIC TESTS ON TANKS

Numbered ..... to ..... inclusive
Size ..... inches outside by .... inches long
Built by ..... Company
For ..... Company

Serial Nos. of tanks	Actual test pressure (psig)	Total expansion (cubic cm)	Permanent expansion (cubic cm)	Percent ratio of permanent expansion to total expansion [1]	Tare weight (pounds) [2]	Capacity in pounds of water at 60 °F

[1] If tests are made by method involving measurement of amount of liquid forced into tank by test pressure, then the basic data on which calculations are made, such as pump factors, temperature of liquid, coefficient of compressibility of liquid, etc., must also be given.
[2] Do not include protective housing, but state whether with or without valves.

(Signed) _____ (Date) _____

(Place) _____

RECORD OF GENERAL DATA ON TANKS

Numbered ..... to ..... inclusive
Built by ..... Company
For ..... Company

Data obtained as prescribed in §179.500–4(c)							Larger value of the factor D^2+d^2/D^2-d^2	(S) Calculated fiber stress in psi at $^7/_{10}$ marked test pressure	Marked test pressure in psig stamped in tank	Minimum tensile strength of material in psi recorded
Marked end of tank				Other end of tank						
Serial No. of tank	(t) Min. thickness of wall in inches	(d) Max. inside diameter in inches	(D) Calculated value of *D* in inches=*d*+2t	(t) Minimum thickness of wall in inches	(d) Maximum inside diameter in inches	(*D*) calculated value of *D* in inches=*d*+2t				

(Signed) _____

[Amdt. 179–32, 48 FR 27708, June 16, 1983, as amended by 66 FR 45391, Aug. 28, 2001]

APPENDIX A TO PART 179—PROCEDURES FOR TANK-HEAD PUNCTURE-RESISTANCE TEST

1. This test procedure is designed to verify the integrity of new or untried tank-head puncture-resistance systems and to test for system survivability after coupler-to-tank-head impacts at relative speeds of 29 km/hour (18 mph). Tank-head puncture-resistance is a function of one or more of the following: Head thickness, jacket thickness, insulation thickness, and material of construction.

2. *Tank-head puncture-resistance test.* A tank-head puncture-resistance system must be tested under the following conditions:

a. The ram car used must weigh at least 119,295 kg (263,000 pounds), be equipped with a coupler, and duplicate the condition of a conventional draft sill including the draft yoke and draft gear. The coupler must protrude from the end of the ram car so that it is the leading location of perpendicular contact with the impacted test car.

b. The impacted test car must be loaded with water at six percent outage with internal pressure of at least 6.9 Bar (100 psig) and coupled to one or more ''backup'' cars which have a total weight of 217,724 kg (480,000 pounds) with hand brakes applied on the last ''backup'' car.

c. At least two separate tests must be conducted with the coupler on the vertical centerline of the ram car. One test must be conducted with the coupler at a height of 53.3 cm (21 inches), plus-or-minus 2.5 cm (1 inch), above the top of the sill; the other test must be conducted with the coupler height at 79 cm (31 inches), plus-or-minus 2.5 cm (1 inch), above the top of the sill. If the combined thickness of the tank head and any additional shielding material is less than the combined thickness on the vertical centerline of the car, a third test must be conducted with the coupler positioned so as to strike the thinnest point of the tank head.

3. One of the following test conditions must be applied:

Minimum weight of attached ram cars in kg (pounds)	Minimum velocity of impact in km/hour (mph)	Restrictions
119,295 (263,000) ...	29 (18)	One ram car only.
155,582 (343,000) ...	25.5 (16)	One ram car or one car plus one rigidly attached car.
311,164 (686,000) ...	22.5 (14)	One ram car plus one or more rigidly attached cars.

4. A test is successful if there is no visible leak from the standing tank car for at least one hour after impact.

[Amdt. 179–50, 60 FR 49078, Sept. 21, 1995, as amended by Amdt. 179–50, 61 FR 33256, June 26, 1996; 66 FR 45390–45391, Aug. 28, 2001]

APPENDIX B TO PART 179—PROCEDURES FOR SIMULATED POOL AND TORCH-FIRE TESTING

1. This test procedure is designed to measure the thermal effects of new or untried thermal protection systems and to test for system survivability when exposed to a 100-minute pool fire and a 30-minute torch fire.

2. *Simulated pool fire test.*

a. A pool-fire environment must be simulated in the following manner:

(1) The source of the simulated pool fire must be hydrocarbon fuel with a flame temperature of 871 °C (1,600 °F), plus-or-minus 37.8 °C (100 °F), throughout the duration of the test.

(2) A square bare plate with thermal properties equivalent to the material of construction of the tank car must be used. The plate dimensions must be not less than one foot by one foot by nominal 1.6 cm (0.625 inch) thick. The bare plate must be instrumented with not less than nine thermocouples to record the thermal response of the bare plate. The thermocouples must be attached to the surface not exposed to the simulated pool fire and must be divided into nine equal squares with a thermocouple placed in the center of each square.

(3) The pool-fire simulator must be constructed in a manner that results in total flame engulfment of the front surface of the bare plate. The apex of the flame must be directed at the center of the plate.

(4) The bare plate holder must be constructed in such a manner that the only heat transfer to the back side of the bare plate is by heat conduction through the plate and not by other heat paths.

(5) Before the bare plate is exposed to the simulated pool fire, none of the temperature recording devices may indicate a plate temperature in excess of 37.8 °C (100 °F) nor less than 0 °C (32 °F).

(6) A minimum of two thermocouple devices must indicate 427 °C (800 °F) after 13 minutes, plus-or-minus one minute, of simulated pool-fire exposure.

b. A thermal protection system must be tested in the simulated pool-fire environment described in paragraph 2a of this appendix in the following manner:

(1) The thermal protection system must cover one side of a bare plate as described in paragraph 2a(2) of this appendix.

(2) The non-protected side of the bare plate must be instrumented with not less than nine thermocouples placed as described in paragraph 2a(2) of this appendix to record the thermal response of the plate.

(3) Before exposure to the pool-fire simulation, none of the thermocouples on the thermal protection system configuration may indicate a plate temperature in excess of 37.8 °C (100 °F) nor less than 0 °C (32 °F).

(4) The entire surface of the thermal protection system must be exposed to the simulated pool fire.

(5) A pool-fire simulation test must run for a minimum of 100 minutes. The thermal protection system must retard the heat flow to the plate so that none of the thermocouples on the non-protected side of the plate indicate a plate temperature in excess of 427 °C (800 °F).

(6) A minimum of three consecutive successful simulation fire tests must be performed for each thermal protection system.

3. *Simulated torch fire test.*

a. A torch-fire environment must be simulated in the following manner:

(1) The source of the simulated torch must be a hydrocarbon fuel with a flame temperature of 1,204 °C (2,200 °F), plus-or-minus 37.8 °C (100 °F), throughout the duration of the test. Furthermore, torch velocities must be 64.4 km/h ±16 km/h (40 mph ±10 mph) throughout the duration of the test.

(2) A square bare plate with thermal properties equivalent to the material of construction of the tank car must be used. The plate dimensions must be at least four feet by four feet by nominal 1.6 cm (0.625 inch) thick. The bare plate must be instrumented with not less than nine thermocouples to record the thermal response of the plate. The thermocouples must be attached to the surface not exposed to the simulated torch and must be divided into nine equal squares with a thermocouple placed in the center of each square.

(3) The bare plate holder must be constructed in such a manner that the only heat transfer to the back side of the plate is by heat conduction through the plate and not by other heat paths. The apex of the flame must be directed at the center of the plate.

(4) Before exposure to the simulated torch, none of the temperature recording devices may indicate a plate temperature in excess of 37.8 °C (100 °F) or less than 0 °C (32 °F).

(5) A minimum of two thermocouples must indicate 427 °C (800 °F) in four minutes, plus-or-minus 30 seconds, of torch simulation exposure.

b. A thermal protection system must be tested in the simulated torch-fire environment described in paragraph 3a of this appendix in the following manner:

(1) The thermal protection system must cover one side of the bare plate identical to that used to simulate a torch fire under paragraph 3a(2) of this appendix.

(2) The back of the bare plate must be instrumented with not less than nine thermocouples placed as described in paragraph 3a(2) of this appendix to record the thermal response of the material.

(3) Before exposure to the simulated torch, none of the thermocouples on the back side of the thermal protection system configuration may indicate a plate temperature in excess of 37.8 °C (100 °F) nor less than 0 °C (32 °F).

(4) The entire outside surface of the thermal protection system must be exposed to the simulated torch-fire environment.

(5) A torch-simulation test must be run for a minimum of 30 minutes. The thermal protection system must retard the heat flow to the plate so that none of the thermocouples on the backside of the bare plate indicate a plate temperature in excess of 427 °C (800 °F).

(6) A minimum of two consecutive successful torch-simulation tests must be performed for each thermal protection system.

[Amdt. 179–50, 60 FR 49078, Sept. 21, 1995]

PART 180—CONTINUING QUALIFICATION AND MAINTENANCE OF PACKAGINGS

Subpart A—General

Subpart B [Reserved]

Subpart C—Qualification, Maintenance and Use of Cylinders

Subpart D—Qualification and Maintenance of IBCs

Subpart E—Qualification and Maintenance of Cargo Tanks